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Annotated bibliography of the eastern larch beetle, *Dendroctonus simplex* Leconte (Coleoptera : Scolytidae)

D.W. Langor and A.G. Raske

Information Report N-X-266
Newfoundland Forestry Centre

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ANNOTATED BIBLIOGRAPHY OF THE EASTERN LARCH BEETLE, *DENDROCTONUS SIMPLEX* LECONTE (COLEOPTERA: SCOLYTIDAE)

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ABSTRACT

Annotations are provided for 192 references that mention the eastern larch beetle (Dendroctonus simplex LeConte). The bibliography includes references from the original description in 1868 to 1987. An index to authors, a subject index and a geographic index are provided for ready reference to specific information.

RÉSUMÉ

Cent, quatre-vingt et douze références bibliographiques mentionnant le dendroctone du mélèze (Dendroctonus simplex LeConte) sont annotées. Ces références couvrent la période de 1868, année de la premièr description, à 1987. Un index des auteurs ainsi qu'un index des sujets et un index géographique sont fournis pour faciliter la recherche d'informations particulières.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
INTRODUCTION	1
BIBLIOGRAPHY	2
AUTHOR INDEX	33
SUBJECT INDEX	35
GEOGRAPHIC INDEX	37

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ANNOTATED BIBLIOGRAPHY OF THE EASTERN LARCH BEETLE, *DENDROCTONUS SIMPLEX* LECONTE (COLEOPTERA: SCOLYTIDAE)

by

D.W. Langor[1] and A.G. Raske[2]

INTRODUCTION

Dendroctonus simplex is a phloeophagous or phloem-feeding bark beetle that occurs throughout North America from Newfoundland and the northeastern United States to British Columbia and Alaska. Its principal host is tamarack, *Larix laricina* (Du Roi) K. Koch, but other species of exotic *Larix* planted within its range are also attacked. This bark beetle species is reputedly a secondary pest which commonly attacks felled host material and weakened trees commonly stressed by drought and defoliation (Wood 1982; Werner 1986). However, in the early 1970s populations of *D. simplex* reached outbreak levels in south-central Quebec and the Atlantic Provinces of Canada as well as the states of Maine, New Hampshire, Vermont, New York and Alaska and caused much damage (Langor and Raske 1989).

It was difficult to locate published information on this significant forest pest and, for much of the literature, the titles did not indicate inclusion of information on *D. simplex*. Therefore, to aid other researchers who may be interested in *D. simplex* we have compiled an annotated bibliography of the literature on this beetle, inclusive to 1987. Many of the Forest Insect and Disease Survey reports lack detail on *D. simplex* activity but are included for completeness. Each publication has also been indexed by author, subject and survey information by geographic names: provinces, territories and states.

[1]Forestry Canada, Northern Forestry Centre, 5320 122 Street, Edmonton, AB, T6H 3S5

[2]Forestry Canada, Newfoundland Forestry Centre, P.O. Box 6028, St. John's, NF, A1C 5X8

BIBLIOGRAPHY

1. Anderson, R.F. 1960. **Forest and Shade Tree Entomology.** John Wiley and Sons, New York, NY, 428 pp. (p. 228).

   D. simplex is briefly described and its distribution is given as the northeastern United States and eastern Canada. A brief outline of life history and description of egg galleries is provided, based on previously published information. It is suggested that penetrating insecticidal sprays may be effective for controlling D. simplex.

2. Applejohn, M.J. 1965. **Status of insects in the Swastika district.** pp. E35-42 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1964. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. E40).

   High populations of D. simplex are reported at two locations (not specified) in Ontario.

3. Ashworth, A.C., D.P. Schwert, W.A. Watts and H.E. Wright, Jr. 1981. **Plant and insect fossils at Norwood in south-central Minnesota: a record of late glacial succession.** Quaternary Res. 16:66-79.

   Fossils of D. simplex were found in silt deposits at the Norwood site in Sibley Co., Minnesota. Based on radiocarbon dating of peat overlaying the silt, the fossils dated more than 12 400 years old.

4. Baker, B.H., B.B. Hostetler and M.M. Furniss. 1977. **Response of eastern larch beetle (Coleoptera: Scolytidae) in Alaska to its natural attractant and to Douglas-fir beetle pheromones.** Can. Ent. 109:289-294.

   Seudenol combined with α-pinene attracted D. simplex to sticky traps and was considered a useful means of studying the species in the field. D. simplex was not attracted to frontalin + α-pinene. 3-methyl-2-cyclohexen-1-one (MCH) reduced attraction.

5. Baker, B.H., B.B. Hostetler and T.A. Laurent. 1975. **Forest insect and disease conditions in Alaska, 1974.** USDA, For. Serv., Alaska Region, Juneau, AK, 13 pp. (p. 4).

   This is the first recorded outbreak of the eastern larch beetle in Alaska. Infested trees were scattered over 53 000 ha about 90 km southwest of Fairbanks.

6. _____ 1977. In **Forest insect and disease conditions in the United States 1974.** (H.B. Toko and T.J. Rogers, comp.) USDA, For. Serv., Report, Washington, DC, 55 pp. (p. 4).

   The bark beetle affected trees in a 129 000 acre area in the upper Kantishna River drainage, Alaska.

7. Baker, B.H. and T.A. Laurent. 1975. In **Forest insect and disease conditions in the United States 1973.** (J.F. Chancelor and H.B. Toko, comp.) USDA, For. Serv., Report, Washington, DC, 55 pp. (pp. 6-7).

Widespread yellowing of larch occurred in the interior of Alaska about 140 mi southwest of Fairbanks. Some previous larch mortality was evident. The condition occurred in a 500 square mile area along several rivers. (Note: The larch beetle was associated with dead and dying larch the following year.)

8. Baker, W.L. 1972. **Eastern forest insects.** USDA, For. Serv., Misc. Publ. 1175, Washington, DC, 642 pp. (p. 248).

Contains a brief description of D. simplex biology condensed from previous publications.

9. Baranyay, J.A. and R.E. Stevenson. 1966. **Alberta - Northwest Territories - Yukon region.** pp. 81-92 In Annual report of the Forest Insect and Disease Survey, 1965. Can. Dept. For., Ottawa, ON (p. 85).

Reports D. simplex infestations in Alberta and in tamarack previously defoliated by the larch sawfly in the Northwest Territories.

10. Barr, B.A. 1969. **Sound production in the Scolytidae (Coleoptera) with emphasis on the genus Ips.** Can. Ent. 101:636-672.

D. simplex has the elytra - abdominal tergite type of stridulating organ with the pars stridens located on the eighth abdominal tergite.

11. Benoit, P. and R. Blais. 1984. **Pertes de bois causées par le dendroctone du mélèze.** Phytoprotection 65:89 (abstract).

In 1980, 41 tamarack sites, most in southern Quebec, were surveyed for D. simplex infestations. Of the 182 ha surveyed 93 were infested. The volume of tamarack killed or dying from beetle attacks was 3030 m^3 (7039 trees). The average diameter of dead trees was 22 cm. (Note: The data contained in this publication are an update of those contained in Lachance et al. 1984.)

12. Benoit, P., G. Laflamme, G. Bonneau and R. Picher. 1982. **Insectes et maladies des arbres Québec - 1981.** For. Conserv. 48(10):1-19 (p. 10).

Reports an increase in D. simplex infestation in south-central Quebec, especially south of Montreal along the border with the United States.

13. _____ 1983. **Insectes et maladies des arbres Québec - 1982.** For. Conserv. 49(10):1-23 (p. 11).

Reports an increase in D. simplex infestations along the United States - Canada border south of Montreal.

14. Bentz, B.J. 1984. **Phenetic and phylogenetic relationships among Dendroctonus (Coleoptera: Scolytidae) bark beetles.** M.S. thesis, Dept. of Forest Resources, University of Idaho, Moscow, ID, 109 pp. (unpublished).

D. simplex was variable at 10 enzyme loci and monomorphic at eight. Based on electrophoretic data D. simplex was most similar to Dendroctonus pseudotsugae Hopkins.

15. Bentz, B.J. and M.W. Stock. 1986. **Phenetic and phylogenetic relationships among ten species of Dendroctonus bark beetles (Coleoptera: Scolytidae).** Ann. Ent. Soc. Amer. 79:527-534. Contains same information as Bentz 1984.

16. Bergdahl, D.R. 1982. **Occurrence of the pinewood nematode in eastern larch.** pp. 47-55 In J.E. Appleby and R.B. Malek (eds.). Proceedings of the 1982 national pine wilt disease workshop, Rosemont, IL.

The pinewood nematode may be responsible for much of the observed tamarack mortality in Vermont with D. simplex subsequently attacking dying trees. Species of the fungus Verticicladiella [especially V. penicillata (Grosm.) Kendrick] were isolated from D. simplex adults.

17. Bergdahl, D.R., D.L.K. Smeltzer and S.S. Halik. 1984. **Components of a conifer wilt disease complex in the northeastern United States.** Proceedings of the joint U.S.-Japan pine wilt disease seminar. Honolulu, HI (abstract).

Tamarack infested with pinewood nematode in Vermont were also commonly infested with D. simplex.

18. Blackman, M.W. and H.H. Stage. 1918. **Notes on insects bred from bark and wood of the American larch.** New York State Coll. For., Tech. Publ. 10, vol. 18:9-115 (pp. 39-41).

Summarizes biology of D. simplex based on previous publications. From 1915-17 in New York state, large numbers of the bark beetle Polygraphus rufipennis (Kirby) (Scolytidae) were associated with D. simplex in tamarack. Many D. simplex adults were entrapped and killed by resin when attacking tamarack. The predator, Phyllobaenus dislocatus Say (Cleridae) and two parasitoids, Spathius canadensis Ashmead (=S. tomici Ashmead) (Braconidae) and a chalcid species, were associated with D. simplex in the state.

19. Bright, D.E. 1971. **Bark beetles from Newfoundland (Coleoptera: Scolytidae).** Ann. Soc. Ent. 16:124-127.

D. simplex was reported on tamarack in western Newfoundland. This is the first record from the province.

20. Bright, D.E. 1976. **The bark beetles of Canada and Alaska (Coleoptera: Scolytidae).** Can. Dept. Agric., Publ. 1576, Ottawa, ON, 241 pp. (pp. 62-63).

Contains keys to Canadian species of Dendroctonus, description of D. simplex adults, distribution and biology condensed from previous publications.

21. Brown, A.W.A. 1939. **The eastern larch beetle.** p. 23 In Annual report of the Forest Insect and Disease Survey, 1939. Can. Dept. Agric., Ottawa, ON (p. 23).

A severe infestation of tamarack by D. simplex was reported at South Milford, Nova Scotia in 1939.

22. Brown, C.E., M.C. Hopkins and J.K. Robins. 1960. **Province of Alberta forest insect survey.** pp. 81-87 In Annual report of the Forest Insect and Disease Survey, 1959. Can. Dept. Agric., Ottawa, ON (p. 86).

Reports a D. simplex infestation at Lac La Biche, Alberta.

23. Brown, C.E. and R.E. Stevenson. 1964. **Province of Alberta forest insect conditions.** pp. 97-102 In Annual report of the Forest Insect and Disease Survey, 1963. Can. Dept. For., Ottawa, ON (p. 99).

D. simplex was more frequent in Alberta in 1963 than in previous years.

24. Browne, F.G. 1968. **Pests and diseases of forest plantation trees.** Clarendon Press, Oxford, 1330 pp. (p. 227).

Reports D. simplex as a pest of Larix spp. in Alaska, Canada and the northeastern United States. Includes a brief description of the life history of the beetle condensed from previous publications.

25. Bushing, R.W. 1965. **A synoptic list of the parasites of Scolytidae (Coleoptera) in North America north of Mexico.** Can. Ent. 97:449-492.

Cosmophorus dendroctoni Viereck (Braconidae), Spathius canadensis Ashmead (=S. tomici Ashmead) (Braconidae), and Heydenia unica Cook and Davis (Pteromalidae) were recorded as parasites of D. simplex.

26. Caltrell, R.M. 1969. **Annual district report Grande Prairie - Peace River district, 1968.** pp. 55-63 In Annual reports of the Forest Insect and Disease Survey Alberta - Northwest Territories - Yukon region, 1968. Can. Dept. Fish. For., For. Res. Lab., Info. Rep. A-X-22, Calgary, AB (p. 60).

Reports moderate D. simplex populations in tamarack southwest of Wapiti, Alberta.

27. Caltrell, R.M. 1970. **Annual district report Grande Prairie - Peace River district, 1969.** pp. 36-42 In Annual district reports of the Forest Insect and Disease Survey Alberta - Northwest Territories - Yukon region, 1969. Can. For. Serv., For. Res. Lab., Info. Rep. A-X-30, Calgary, AB (p. 60).

Low populations of D. simplex were reported in tamarack at mile 9 of Two Lakes Road, Alberta.

28. Chamberlin, W.J. 1939. **The bark and timber beetles of North America north of Mexico.** Oregon State College Coop. Assoc., Corvallis, OR, 513 pp. (pp. 42, 162).

A brief description of adults, distribution and summary of biology is provided based on information in previous publications. Cosmophorus dendroctoni Viereck (Braconidae) is recorded as a parasitoid of D. simplex.

29. Clarke, L.J., E.C. Banfield, W.J. Sutton, D.M. Stone, D.S. O'Brien, K.E. Pardy and G.C. Carew. 1979. **1978 annual district report Forest Insect and Disease Survey.** Can. For. Serv., Nfld. For. Res. Cent., Info. Rep. N-X-168, St. John's, NF, 66 pp. (p. 28).

High mortality of spruce budworm-weakened tamarack due to D. simplex attacks was reported along the Trans Canada Highway and some major secondary roads in central Newfoundland.

30. _____ 1980. **1979 annual district report Forest Insect and Disease Survey Newfoundland.** Can. For. Serv., Nfld. For. Res. Cent., Info. Rep. N-X-183, St. John's, NF, 68 pp. (p. 26).

Reports increasing mortality of tamarack in 1979 due to D. simplex attacks in central and western Newfoundland.

31. _____ 1981. **1980 annual district report Forest Insect and Disease Survey Newfoundland.** Can. For. Serv., Nfld. For. Res. Cent., Info. Rep. N-X-195, St. John's, NF, 65 pp. (p. 27).

Reports D. simplex infestations in central and western Newfoundland.

32. Clarke, L.J., E.C. Banfield, W.J. Sutton, D.M. Stone, D.S. O'Brien, K.E. Pardy and G.C. Carew. 1982. **1981 annual district report Forest Insect and Disease Survey Newfoundland.** Can. For. Serv., Nfld. For. Res. Cent., Info. Rep. N-X-209, St. John's, NF, 65 pp. (p. 24).

In 1981, D. simplex infestations continued in central and western Newfoundland and new infestations appeared on the Avalon Peninsula. A survey of damaged stands estimated a dead tamarack volume of 18 500 m^3 for the island.

33. Clarke, L.J. and G.C. Carew. 1983. **Forest insect and disease conditions in Newfoundland and Labrador, 1982.** Can. For. Serv., Nfld. For. Res. Cent., Info. Rep. N-X-214, St. John's, NF, 21 pp. (p. 17).

In 1982, D. simplex populations in central and eastern Newfoundland declined but new infestations appeared on the Avalon Peninsula.

34. Clarke, L.J. and G.C. Carew. 1984a. **Forest insect and disease conditions in Newfoundland and Labrador in 1983.** Can. For. Serv., Nfld. For. Res. Cent., Info. Rep. N-X-223, St. John's, NF, 28 pp. (p. 23).

In 1983, most D. simplex infestations declined, especially on the Avalon Peninsula. However, scattered new spot infestations occurred across the island. The beetle appeared to be killing healthy, vigorous trees.

35. _____ 1984b. **Forest insect and disease conditions in Newfoundland and Labrador in 1984.** Can. For. Serv., Nfld. For. Res. Cent., Woody Points 13(4):4, St. John's, NF.

High populations of D. simplex were reported in tamarack previously defoliated by larch sawfly in parts of Labrador.

36. _____ 1985. **Forest insect and disease conditions in Newfoundland and Labrador in 1984.** Can. For. Serv., Nfld. For. Res. Cent., Info. Rep. N-X-229, St. John's, NF, 31 pp. (p. 24).

Reports high populations of D. simplex in tamarack previously defoliated by larch sawfly in parts of Labrador.

37. _____ 1986. **Forest insect and disease conditions in Newfoundland and Labrador in 1985.** Can. For. Serv., Nfld. For. Res. Cent., Info. Rep. N-X-241, St. John's, NF, 33 pp. (p. 23).

In 1985, D. simplex populations were at or near endemic levels throughout the island except for a few stands south of Gander Lake.

38. Craighead, F.C. 1950. **Insect enemies of eastern forests.** USDA, For. Serv., Misc. Publ. 657, Washington, DC, 679 pp. (p. 319).

Contains description of adults, distribution and brief review of the biology of D. simplex condensed from previous publications.

39. Dearborn, R.G. and D.A. Stark. 1986. **Forest and shade tree insect and disease conditions for Maine: summary issue for the 1985 season.** Maine Dept. Conserv., For. Serv., Ent. Lab., Rep. 85-18, Augusta, ME, 16 pp. (p. 7).

D. simplex was associated with tamarack mortality throughout the state in 1985. A predisposing factor was not identified.

40. Dietz, W.G. 1890. **Notes on the species of Dendroctonus of boreal America.** Trans. Amer. Ent. Soc. 17:27-32.

A brief description of D. simplex adults and records from Michigan and Lake Superior is given. False records from Colorado and California are mentioned. A key to six species of the genus is provided.

41. Doane, R.W., E.C. van Dyke, W.J. Chamberlin and H.E. Burke. 1936. **Forest Insects.** McGraw-Hill Book Co. Inc. New York, NY, 463 pp. (p. 81).

Reports D. simplex infesting logs, stumps and felled and weakened tamarack in the northeastern and Lake states.

42. Dodge, H.R. 1938. **The bark beetles of Minnesota (Coleoptera: Scolytidae).** Univ. Minnesota, Agric. Exp. Stn., Tech. Bull. 132, 60 pp. (pp. 26-27).

There is one generation of D. simplex per year in Minnesota. Platysoma sp. (Histeridae) and a clerid species were reported as predators of D. simplex in the state. The distribution of the species in the state is given.

43. Drouin, J.A. and W.J. Turnock. 1967. **Occurrence of the eastern larch beetle in Manitoba and Saskatchewan.** Manitoba Ent. 1:18-20.

Numerous localized D. simplex infestations occurred in the southern quarter of Manitoba and from Prince Albert northwestward to the Alberta border in Saskatchewan from 1961-67. There was 50% mortality of tamarack at a plot near Rennie, Manitoba. Larch sawfly defoliation was implicated as a predisposing agent. Some notes on attack patterns are included.

44. Duncan, B. 1987. **An illustrated guide to the identification and distribution of the species of Dendroctonus Erichson (Coleoptera: Scolytidae) in British Columbia.** J. Ent. Soc. British Columbia 84:101-112.

A key to the eight species of Dendroctonus occurring in British Columbia is provided. D. simplex is recorded as occurring in the northeastern part of the province.

45. Emond, F.J. 1969. **Annual district report west-central district, 1968.** pp. 33-44 In Annual district reports of the Forest Insect and Disease Survey Alberta - Northwest Territories - Yukon region, 1968. Can. Dept. Fish. For., For. Res. Lab., Info. Rep. A-X-22, Calgary, AB (p. 39).

    Moderate populations of D. simplex were found in tamarack in the Blue Ridge area of Alberta.

46. Eidmann, H. 1962. **Regelmassigkeiten im Wachstum und die Bestimmung der Larvenstadien von Insekten.** Ent. Tichskrift. 83:153-163.

    D. simplex is reported to have four larval instars.

47. Fall, H.C. and T.D.A. Cockerell. 1907. **The Coleoptera of New Mexico.** Trans. Amer. Ent. Soc. 23:145-218.

    Reports D. simplex from New Mexico. This is a false record.

48. Felt, E.P. 1924. **Manual of tree and shrub insects.** The MacMillan Co., New York, NY, 382 pp. (p. 257).

    Reports D. simplex attacking injured, dying and dead larch in the northeastern United States and Canada. One generation of beetles per year is reported. It is recommended that infested trees be debarked, burned or placed in water. Trap trees felled in May and June may be used to attract and control beetles.

49. Felt, E.P. and W.H. Rankin. 1938. **Insects and diseases of ornamental trees and shrubs.** The MacMillan Co., New York, NY, 507 pp. (p. 405).

    Reports D. simplex as a pest of eastern larch (= tamarack).

50. Foster, H.R. 1961. **Status of insects in the Lake Erie district.** pp. 106-123 In Annual report of the forest biology rangers of Ontario, 1960. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. 109).

    Tamarack was killed by D. simplex at four localities in Norfolk Co. in Ontario. In Middleton Twp., 50% of a small stand of tamarack were killed. A few European larch were killed in two plantations near Lynedock and in one at Turkey Point. There was no evidence of a predisposing agent.

51. Foster, H.R. 1962. **Status of insects in the Lake Erie district.** pp. 113-134 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1961. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. 118).

Mortality of tamarack continued in Middleton Township, Ontario and mortality of European larch continued near Lynedock and Turkey Point.

52. _____ 1963. **Status of insects and tree diseases in the northern forest region.** pp. E1-8 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1962. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. E3-4).

From 0% to 80% mortality of tamarack due to D. simplex attacks occurred at 10 locations in the Cochrane, Swastika and Kapuskasing forest districts in Ontario. Larch sawfly defoliation was implicated as a stressing agent.

53. _____ 1964. **Status of insects and tree diseases in the northern forest region.** pp. E1-9 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1963. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. E2).

Reports a decline in D. simplex populations in Ontario in the Cochrane and Swastika districts from the two previous years. Infestations were light in McGarry, Burt and Holmes townships.

54. Furniss, M.M. 1976. **Controlled breeding, comparative anatomy and bionomics of Dendroctonus simplex LeConte and Dendroctonus pseudotsugae Hopkins (Coleoptera: Scolytidae).** pp. 109-120 In Barr, W.F. (ed.). Univ. Idaho, Dept. Ent., Anniv. Publ. 15.

Forty percent of crosses between female D. simplex and male D. pseudotsugae were productive in tamarack and western larch, whereas, reciprocal pairings failed. Biological and anatomical comparisons were made between species, including observations on the seminal rod, stridulating file and antennae. D. simplex biology was summarized and the parasites common to both beetle species were listed. Other species of scolytids commonly associated with D. simplex were also listed.

55. Furniss, R.L. and V.M. Carolin. 1980. **Western forest insects.** USDA, For. Serv., Misc. Publ. No. 1339. Washington, DC, 654 pp. (pp. 361-362).

The distribution of D. simplex in western North America is given along with some notes on biology, based on information contained in previous publications. An extensive outbreak of D. simplex which started in Alaska in 1973 is mentioned.

56. Gautreau, E.J. 1970. **Annual district report MacKenzie district, 1969.** pp. 43-52 In Annual report of the Forest Insect and Disease Survey Alberta - Northwest Territories - Yukon region, 1969. Can. For. Serv., For. Res. Lab., Info. Rep. A-X-30, Calgary, AB (p. 45).

About 5% of tamarack were attacked by D. simplex between Fort Providence and Tathlina Lake, Northwest Territories. A few tamarack were killed by D. simplex in Wood Buffalo National Park.

57. Grisdale, D.G. 1962. **Status of insects and tree diseases in the northern forest region.** pp. 304-316 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1962. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie., ON (pp. 309-313).

Reports tamarack mortality due to D. simplex attacks in the Cochrane (71% mortality in plots) and Swastika (54%) forest districts and low mortality in the Kapuskasing district, Ontario. Tamarack of various diameters were killed but larger trees were more frequently attacked. Larch sawfly defoliation was implicated as a stressing agent.

58. Grisdale, D.G. and L.S. MacLeod. 1962. **Tamarack mortality associated with infestations of the larch sawfly and eastern larch beetle.** Can. Dept. For., Bi-month. Prog. Rep. 18(5):2.

Contains the same information as Grisdale (1962).

59. Harrington, W.H. 1884. (no title). Can. Ent. 16:218.

Reports D. simplex attacking tamarack in Ontario in 1883.

60. _____ 1891. **Notes on a few Canadian Rhynchophora.** Can. Ent. 23:21-27.

Reports D. simplex attacking a grove of tamarack about three miles from Ottawa.

61. Herrick, G.W. 1935. **Insect enemies of shade trees.** Comstock Publ. Co., Ithaca, NY, 417 pp. (pp. 137-138).

Reports D. simplex as the most serious bark beetle attacking larch species in North America. A brief description is given and burning of infested trees is recommended as a method of control.

62. Hewitt, C.G. 1915. **Report of the dominion entomologist for the year ending March 31, 1915.** Can. Dept. Agric., Ottawa, ON (p. 36).

Reports small D. simplex infestations at Mitsue and Smith, Alberta in 1914. This is the earliest record of a D. simplex infestation in Alberta.

63. Hofaker, T.H., R.C. Loomis and S.M. Tucker (comp.). 1984. **Forest insect and disease conditions in the United States 1983.** USDA, For. Serv. Report, Washington, DC, 72 pp. (p. 56).

Populations of D. simplex are at endemic levels throughout the interior of Alaska; only 100 acres of infested tamarack were detected in 1983.

64. Holsten, E.H., A. Eglitis, and T.A. Laurent. 1981. Alaska Region. pp. 68-71. In **Forest insect and disease conditions in the United States 1979.** (H.D. Brown and P.W. Orr, comp.). USDA, For. Serv., Gen. Tech. Rep. WO-20, Washington, DC, 91 pp. (p. 68-69).

Eastern larch beetle infestations have decreased in the interior of Alaska from 35,590 acres in 1978 to 15,992 acres in 1979. Most beetle activity occurred southeast of Fairbanks along the Tanana and Teklanika Rivers. Other infestations occurred along the Anvik and the Yukon Rivers, and just outside McKinley National Park.

65. Holsten, E.H., P.E. Hennon and R.A. Werner. 1985. **Insects and diseases of Alaskan forests.** USDA, For. Serv., Alaska Region, Rep. 181, Juneau, AK, 217 pp. (p. 65).

During an aerial survey in 1973, yellowing, D. simplex-infested tamarack were noted 90 km southwest of Fairbanks. Infested trees were widely scattered over 47 000 ha.

66. Holsten, E.H., T.A. Laurent and R.D. Averil. 1980. Alaska Region. pp. 64-66. In **Forest insect and disease conditions in the United States 1978.** (P.W. Orr and H.D. Brown, comp.). USDA, For. Serv., GTR-WO-19, Washington, DC, 83 pp. (p. 64).

Eastern larch beetle infestations in the interior of Alaska decreased dramatically from 532 000 acres in 1977 to 35 590 acres in 1978. The infestation moved northeastward from the upper Kantishna River drainage where it originated in 1974. Scattered mortality occurred along the Tanana River near Fairbanks.

67. Hopkins, A.D. 1898. **Insects detrimental and destructive to timber and timber products.** pp. 103-108 In Proc. 19th Ann. Meet. Soc. Prom. Agric. Sci., Boston, MA (p. 105).

D. simplex was blamed for the destruction of tamarack and spruce in eastern forests. The killing of spruce is a false record.

68. _____ 1899a. (no title). Proc. Ent. Soc. Washington 4:343.

Reports finding D. simplex in tamarack in West Virginia at an elevation of 2600 ft.

69. _____ 1899b. **Report on investigations to determine the cause of unhealthy conditions of the spruce and pine from 1880-1893.** West Virginia Agric. Exp. Stn., Bull. No. 56, Morgantown, WV. (pp. 394, 447-448).

Contains a brief description of D. simplex and reports that tamarack was killed by D. simplex in Preston Co., West Virginia. Records of the species from California and Colorado are also mentioned but these are false.

70. _____ 1909a. **Contributions toward a monograph of the scolytid beetles. I. The genus Dendroctonus.** USDA, Bur. Ent., Tech. Ser. 17, 164 pp. (pp. 117-121).

A description of adults, pupae and larvae is provided. Egg galleries are described as winding, occasionally branched and often scoring the wood. Eggs are placed in groups of 3-5 along the sides of the gallery. The species is reported to occur in the eastern half of Canada and in the northeastern United States. A brief literature review is provided.

71. _____ 1909b. **Practical information on the scolytid beetles of North American forests. I. Bark beetles of the genus Dendroctonus.** USDA, Bur. Ent., Bull. 83, part 1, 169 pp. (pp. 103-105).

A description of adult D. simplex is provided. Egg galleries are described as long and winding. Eggs are laid in pockets in the sides of the gallery in groups of 3-6. The species overwinters principally in the adult stage beneath the bark of trees and stumps. Emergence and oviposition occurs in early spring. New adults appear in July. There is only one generation per year. D. simplex may be capable of devasting larch forests especially with the aid of defoliating insects. Trap logs are recommended as a method of control.

72. Hostetler, B.B., P.A. Rush and T.A. Laurent. 1976. **Forest insect and disease conditions in Alaska, 1975.** USDA, For. Serv., Alaska Region, Juneau, AK, 12 pp. (pp. 4-5).

D. simplex-infested tamarack were widely scattered over a 142 000 ha area southwest of Fairbanks, Alaska. This is a 3-fold increase in area from the previous year.

73. Howse, G.M., P.D. Syme, H.L. Gross, D.T. Myron and M.J. Applejohn. 1981. **Forest insect and disease conditions in Ontario, 1980.** Can. For. Serv., Great Lakes For. Res. Cent., Info. Rep. O-X-327, Sault Ste. Marie, ON, 50 pp. (p. 40).

Reports high populations of D. simplex in tamarack in South Gower Township, Brockville district, Ontario.

74. Jackson, G.G. 1962. **Status of insects in the Kenora district.** pp. 444-457 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1961. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. 453).

D. simplex killed some tamarack in Mutrie Township.

75. Jansons, V. 1963. **Status of insects in the Geraldton district.** pp. F26-33 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1962. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. F32).

Reports moderate populations of D. simplex at Lydia Lake in the Stevens area, Ontario.

76. _____ 1964. **Status of insects in the Geraldton district.** pp. F18-24 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1963. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. F22).

Reports low D. simplex populations in the eastern part of the Geraldton district, Ontario.

77. Kondo, E.S. and R.G. Taylor (compilers). 1984. **Forest insect and disease conditions in Canada, 1983.** Can. For. Serv., Forest Insect and Disease Survey, Ottawa, ON, 73 pp. (p. 14).

Summarizes D. simplex damage in Canada in 1983 (condensed from regional reports).

78. _____ 1985. **Forest insect and disease conditions in Canada, 1984.** Can. For. Serv., Forest Insect and Disease Survey, Ottawa, ON, 76 pp. (p. 13).

Summarizes D. simplex damage in Canada in 1984 (condensed from regional reports).

79. Kondo, E.S. and R.G. Taylor (compilers). 1986. **Forest insect and disease conditions in Canada, 1985.** Can. For. Serv., Forest Insect and Disease Survey, Ottawa, ON, 107 pp. (p. 20).

Summarizes D. simplex damage in Canada in 1985 (condensed from regional reports).

80. Krombien, K.V., P.D. Hurd, Jr., D.R. Smith and B.D. Burks (comp.). 1979. Catalogue of Hymenoptera in America North of Mexico. Smithsonian Instit. Press, Washington, DC, 2735 pp. (p. 295).

Records the same information as Muesebeck et al. 1951.

81. Kusch, D.S. 1967. **An annotated checklist of the common bark beetles found in Alberta with a field key to genera.** Can. For. Serv., For. Res. Lab., Info. Rep. A-X-8, Calgary, AB, 12 pp.

Gives distribution of D. simplex in Alberta.

82. Lachance, D., P. Benoit, G. Bonneau and G. Laflamme. 1981. **Insectes et maladies des arbres Québec, 1980.** For. Conserv. 47(9):9.

Reports 3% to 90% mortality of tamarack due to D. simplex in stands in the south-central region of Quebec.

83. Lachance, D., P. Benoit, G. Laflamme, G. Bonneau and R. Picher. 1984. **Insectes et maladies des arbres Québec, 1983.** For. Conserv. 50(10):7.

Of 41 sites surveyed (most in south-central Quebec), 35 had some tamarack mortality due to D. simplex, ranging from 11% to 95%. Of the 141 ha surveyed, 76 ha contained D. simplex infested tamarack. The volume of beetle-killed tamarack was estimated at 769 m^3.

84. Langor, D.W. 1984. **Flight ability of re-emerging eastern larch beetles, Dendroctonus simplex LeConte (Coleoptera: Scolytidae), following egg gallery formation and oviposition in tamarack, Larix laricina (Du Roi) K. Koch, in Newfoundland.** Proc. 32nd annual meeting of the Entomological Society of Alberta. Nov. 1-3, 1984. Mount Royal College, Calgary, AB, 52 pp. (p. 9). [abstract].

Contains same information as Langor (1987).

85. Langor, D.W. 1985. **Ecology of the eastern larch beetle, Dendroctonus simplex LeConte (Coleoptera: Scolytidae), in Newfoundland.** M.Sc thesis, Dept. of Biology, Memorial Univ. of Newfoundland, St. John's, NF, 197 pp. (unpublished).

Information on the life history of D. simplex in Newfoundland was presented including emergence, flight, host attack, re-emergence, mating, gallery construction, oviposition, brood development, mortality, predators, parasitoids, overwintering behaviour, and cold tolerance. The information is summarized in the following six publications.

86. Langor, D.W. 1987. **Flight muscle changes in the eastern larch beetle, Dendroctonus simplex LeConte.** Coleopt. Bull. 41:351-357.

Describes flight muscle breakdown and other internal changes in D. simplex during oviposition. Flight muscles regenerated to allow flight in only 15% of parents before re-emergence.

Incomplete flight muscle regeneration in most re-emerged beetles suggests selection for one brood per year in Newfoundland where climate is not conducive to production of a second brood.

87. Langor, D.W. and A.G. Raske. 1984. **Eastern larch beetle being studied.** Can. For. Serv., Nfld. For. Res. Cent., Woody Points 13(1):5-6, St. John's, NF.

Contains a brief review of D. simplex life history and damage caused to tamarack in the Atlantic provinces. A research project designed to study D. simplex biology in Newfoundland is briefly outlined.

88. _____ 1987a. **Emergence, host attack and overwintering behaviour of the eastern larch beetle, Dendroctonus simplex LeConte (Coleoptera: Scolytidae), in Newfoundland.** Can. Ent. 119:975-983.

Overwintering adults emerged and attacked new hosts in May and June. Parents re-emerged and dispersed to new hosts in late June and July and produced a second brood. Although 90% of parents re-emerged few produced second broods. Following production of a second brood parents re-emerged again in August but all died over winter. Thirty-five percent of new brood adults emerged in the fall and crawled or fell to the tree base where they re-entered the tree to overwinter. Only adults survived the winter.

89. _____ 1987b. **Reproduction and development of the eastern larch beetle, Dendroctonus simplex LeConte (Coleoptera: Scolytidae), in Newfoundland.** Can. Ent. 119:985-992.

Describes mating, gallery construction, oviposition and brood development of D. simplex in trees. Egg galleries averaged 42 cm in length. The average number of eggs per gallery averaged 48. Development from egg to adult in the field averaged 60 and 70 days for the first and second broods, respectively.

90. _____ 1988. **Mortality factors and life tables of the eastern larch beetle, Dendroctonus simplex LeConte (Coleoptera: Scolytidae), in Newfoundland.** Environ. Ent. 17:959-963.

Provides life tables for the two sister broods of D. simplex produced in Newfoundland in 1983. Third and fourth larval instars sustained the highest mortality and pupae the lowest. Generally, pathogens caused the highest mortality among eggs, second instar larvae and pupae; resinosis among first instar larvae; and parasitoids among third and fourth instar larvae. Differences in mortality along the tree bole and between sister broods are discussed.

91. Langor, D.W. and A.G. Raske. 1989. **The eastern larch beetle; another threat to our forests.** For. Chron. 65: (in press).

Provides a review of all recorded D. simplex infestations and outbreaks with emphasis on the recent widespread outbreak, which started in the early 1970's in eastern Canada and the north-eastern United States as well as in Alaska. During this outbreak in excess of 1.4 million m^3 of tamarack were killed in the Atlantic provinces. No estimates are available for the United States. Fire, flooding and insect defoliators were the most common factors predisposing tamarack to beetle attack and allowing population build-up.

92. Lanier, G.N. 1981a. **Cytotaxonomy of Dendroctonus.** pp. 33-66 In M.W. Stock (ed.). Applications of genetics and cytology in insect systematics and evolution. Proc. Symp. Natl. Meeting Ent. Soc. Amer., Atlanta, GA, Univ. Idaho Press, Moscow, ID.

Contains a detailed description of the karyotype of D. simplex. The 2n chromosome number is 30 (14AA + XY).

93. _____ 1981b. **Larch beetle (Dendroctonus simplex).** p. 3 In Forest insect and disease problems for New York state, 1980-81. Committee on insects and diseases, New York section, Syracuse, NY.

Records extensive infestations of tamarack by D. simplex in the Adirondacks and on the Tug Hill Plateau, New York.

94. Layton, C.R. 1966. **Annual district report Peace River district, 1965.** pp. 87-98 In Annual district reports of the Forest Insect and Disease Survey Alberta, 1965. Can. Dept. For., For. Res. Lab., Info. Rep. A-X-1, Calgary, AB (p. 93).

Reports D. simplex infestations in tamarack in the harmon Valley and in the Dixonville and Grimshaw areas, Alberta.

95. _____ 1967. **Annual district report Lac La Biche district, 1966.** pp. 62-72 In Annual district reports of the Forest Insect and Disease Survey Alberta - Northwest Territories - Yukon region, 1966. Can. Dept. For., For. Res. Lab., Info. Rep. A-X-6, Calgary, AB (p. 67).

Reports high D. simplex populations in the Sandy Rapids area of Alberta.

96. _____ 1969. **Annual district report northeast district, 1968.** pp. 45-54 In Annual district reports of the Forest Insect and Disease Survey Alberta - Northwest Territories - Yukon region, 1968. Can. Dept. Fish. For., For. Res. Lab., Info. Rep. A-X-22, Calgary, AB (p. 50).

D. simplex was common in fire weakened tamarack throughout the northeast district of Alberta.

97. Layton, C.R. 1970. **Annual district report northeast district, 1969.** pp. 30-35 In Annual district reports of the Forest Insect and Disease Survey Alberta - Northwest Territories - Yukon region, 1969. Can. For. Serv., For. Res. Lab., Info. Rep. A-X-30, Calgary, AB (p. 33).

Reports low D. simplex populations in tamarack northwest of Plamadon, Alberta.

98. LeConte, J.L. 1868. **Appendix and notes to Zimmerman, C. - Synopsis of Scolytidae of America north of Mexico.** Trans. Amer. Ent. Soc. 2:150-178 (p. 173).

Gives original description of D. simplex based on specimens from Canada.

99. _____ 1876. **The Rhynchophora of America north of Mexico.** Proc. Amer. Phil. Soc. 15:341-391 (pp. 384-386).

Gives description of D. simplex adults and key to seven species of Dendroctonus.

100. Livesey, F. 1966. **Status of insects in the Tweed district.** pp. A22-31 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1965. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. A30).

Reports high populations of D. simplex in tamarack in Kennebec Township, Ontario. Trees were believed to be stressed by a change in the water table due to highway construction.

101. Loomis, R.C. and T.H. Hofacker (comp.). 1981. **Forest insect and disease conditions in the United States 1980.** USDA, For. Serv., Report, Washington, DC, 36 pp. (p. 24).

Infestations of the eastern larch beetle have increased slightly in the interior of Alaska from 16 000 acres in 1979 to 20 000 acres in 1980. Most beetle activity is scattered along the Susulatana River.

102. Loomis, R.C., T.H. Hofaker and S.M. Tucker (comp.). 1985. **Forest insect and disease conditions in the United States 1984.** USDA, For. Serv., Report, Washington, DC, 90 pp. (p. 78).

In New York, Armillaria root rot and eastern larch beetle have been associated with dead and dying larch trees. In Maine, newly affected stands have been found. Little new mortality is occurring in Vermont. In New Hampshire, 61% of the larch on 1500 acres is dead or dying, and beetle populations have been increasing for the past 10 years.

103. Magasi, L.P. 1977a. **Eastern larch beetle - another Maritime forest enemy.** Can. For. Serv., Maritimes For. Res. Cent., Pith to Periderm 11(7):28, Fredericton, NB.

Reports start of D. simplex outbreak in Nova Scotia and Prince Edward Island.

104. _____ 1977b. **Forest pest conditions in the Maritimes in 1977 with an outlook for 1978.** Can. For. Serv., Maritimes For. Res. Cent., Info. Rep. M-X-82, Fredricton, NB, 40 pp. (pp. 8-10).

In 1977, the proportion of tamarack killed or recently attacked by D. simplex was 66% and 25%, representing 68% and 31% of merchantable volume at 10 locations surveyed in Nova Scotia and three in Prince Edward Island, respectively.

105. _____ 1979. **Forest pest conditions in the Maritimes in 1978 with an outlook for 1979.** Can. For. Serv., Maritimes For. Res. Cent., Info. Rep. M-X-98, Fredricton, NB, 34 pp. (pp. 7-9).

An estimated 478 300 m^3 of tamarack, most of it in central and eastern Nova Scotia, was reported to be killed by D. simplex up to and including 1978.

106. _____ 1980. **Forest pest conditions in the Maritimes in 1979 with an outlook for 1980.** Can. For. Serv., Maritimes For. Res. Cent., Info. Rep. M-X-106, Fredricton, NB, 34 pp. (p. 25).

The D. simplex outbreak continued throughout the Maritimes in 1979.

107. _____ 1981a. **Forest pest conditions in the Maritimes in 1980.** Can. For. Serv., Maritimes For. Res. Cent., Info. Rep. M-X-118, Fredricton, NB, 35 pp. (p. 6).

Reports an increase in the D. simplex outbreak in the Maritimes in 1980.

108. _____ 1981b. **Maritimes region.** pp. 19-34 In Annual report of the Forest Insect and Disease Survey, 1977. Can. For. Serv., Ottawa, ON (pp. 20-21).

Reports high mortality of tamarack due to D. simplex in Nova Scotia and southeastern Prince Edward Island.

109. _____ 1982a. **Forest pest conditions in the Maritimes in 1981.** Can. For. Serv., Maritimes For. Res. Cent., Info. Rep. M-X-135, Fredricton, NB, 33 pp. (pp. 7-8).

The volume of tamarack killed by D. simplex since 1976 in New Brunswick, Nova Scotia and Prince Edward Island was estimated at 314 400, 972 000 and 11 600 m^3, respectively.

110. Magasi, L.P. 1982b. **Maritimes region.** pp. 17-28 In Annual report of the Forest Insect and Disease Survey, 1978. Can. For. Serv., Ottawa, ON (pp. 18-19).

Reports extensive mortality of tamarack in all Maritime provinces. Merchantable tamarack killed or recently attacked by D. simplex in 42, 47 and 10 plots in Nova Scotia, New Brunswick and Prince Edward Island was 33%, 6% and 25%, respectively.

111. _____ 1982c. **Maritimes region.** pp. 17-27 In Annual report of the Forest Insect and Disease Survey, 1979. Can. For. Serv., Ottawa, ON (p. 21).

The D. simplex outbreak continued to cause extensive tamarack mortality in the Maritimes.

112. _____ 1983. **Forest pest conditions in the Maritimes in 1982.** Can. For. Serv., Maritimes For. Res. Cent., Info. Rep. M-X-141, Fredricton, NB, 41 pp. (p. 8).

D. simplex infestations appeared to decrease in all three Maritime provinces in 1982. Some biological notes are included.

113. _____ 1984a. **Forest pest conditions in the Maritimes in 1983.** Can. For. Serv., Maritimes For. Res. Cent., Info. Rep. M-X-149, Fredricton, NB, 49 pp. (p. 8).

Reports a continued decrease in D. simplex infestations in the Maritimes. In a central research plot in New Brunswick a further 2.9% of tamarack became infested and died in 1983.

114. _____ 1984b. **Important forest pests of larch in the Maritimes.** Can. For. Serv., Maritimes For. Res. Cent., Tech. Note 98, Fredricton, NB, 4 pp.

Reviews D. simplex damage in the Maritimes. Trees as small as 6 cm DBH were attacked by beetles. To control D. simplex, removal of infested trees and protection of valuable trees by chemical means is suggested.

115. _____ 1985. **Forest pest conditions in the Maritimes in 1984.** Can. For. Serv., Maritimes For. Res. Cent., Info. Rep. M-X-154, Fredricton, NB, 49 pp. (pp. 8-9).

D. simplex infestations in the Maritimes continued to decrease in 1984. In a central research plot in New Brunswick, a further 3.8% of tamarack were attacked in 1984.

116. _____ 1986a. **Forest pest conditions in the Maritimes in 1985.** Can. For. Serv., Maritimes For. Res. Cent., Info. Rep. M-X-159, Fredricton, NB, 85 pp. (pp. 8-10).

In Nova Scotia, Prince Edward Island and New Brunswick the proportion of merchantable tamarack killed by D. simplex since 1976 was 23% (up 10% from 1981), 30% (up 6%) and 49% (down 15%), respectively. The decrease in mortality in Nova Scotia since 1981 was thought to be a result of the disappearance of old dead trees from stands.

117. Magasi, L.P. 1986b. **A synopsis of forest pest conditions in the Maritimes in 1986.** Can. For. Serv., Maritimes For. Res. Cent., Tech. Note 172, Fredricton, NB, 4 pp.

Reports a continued downward trend in D. simplex populations in the Maritimes.

118. _____ 1987. **Forest pest conditions in the Maritimes in 1986.** Can. For. Serv., Maritimes For. Cent., Info. Rep. M-X-161, Fredricton, NB, 67 pp. (p. 10).

In a central research plot New Brunswick, a further 6.7% of tamarack was attacked in 1986. This represents a slight increase from the previous year.

119. Maine Dept. of Conservation. 1984. **Annual report 1983.** Maine For. Serv., Ent. Div., Augusta, ME (p. 126).

D. simplex and Armillaria root rot was associated with tamarack decline in the state.

120. _____ 1987. **Forest and shade tree insect and disease conditions for Maine: a summary of the 1986 situation.** Insect and disease management division, summary report 1. Maine For. Serv., Augusta, ME, 22 pp. (p. 4).

D. simplex continued to be associated with tamarack mortality in 1986, and shows potential of increasing in the future.

121. Martineau, R. 1985. **Insectes nuisibles des forets de l'est du Canada.** Editions Marcel Broquet, Inc., Ottawa, ON, 283 pp. (pp. 43-44).

Reports D. simplex as a minor pest of tamarack in eastern Canada. Photographs of life stages and damage are included.

122. Mason, W.R.M. 1978. **A synopsis of the Nearctic Braconini, with revisions of Nearctic species of Coeloides and Myosoma (Hymenoptera: Braconidae).** Can. Ent. 110:721-768.

Coeloides rufovariegatus (Provancher) (Braconidae) is recorded as a parasitoid of D. simplex in the Maritimes.

123. McGuffin, W.C. and R.B. Baker. 1947. **Prairie provinces forested area.** pp. 54-65 In Annual report of the Forest Insect and Disease Survey, 1946. Can. Dept. Agric., Div. Ent., Ottawa, ON (p. 57).

D. simplex infested Siberian larch at the Oliver nursery near Edmonton, Alberta.

124. Moody, B.H., P. Singh and L.J. Clarke. 1982. **Newfoundland region.** pp. 7-16 In Annual report of the Forest Insect and Disease Survey, 1978. Env. Canada, Can. For. Serv., Ottawa, ON (pp. 12-13).

Reports numerous D. simplex infested tamarack in groups of 3-40 in central and western Newfoundland.

125. Muesebeck, C.F.W., K.V. Krombien and H.K. Townes (compilers). 1951. **Hymenoptera of America north of Mexico, synoptic catalogue.** USDA, Monogr. 2, 1420 pp. (p. 183).

Records Cosmophorus (=Cosmophorinus) dendroctoni Viereck (Braconidae) as a parasitoid of D. simplex.

126. Newell, R. 1977. **Forest insect and disease highlights.** Can. For. Serv., Maritimes For. Res. Cent., Pith to Periderm 11(2):11, Fredericton, NB.

Reports D. simplex infestations in Nova Scotia and Prince Edward Island in 1977.

127. _____ 1978. **Forest insect and disease highlights.** Can. For. Serv., Maritimes For. Res. Cent., Pith to Periderm 12(1):3, Fredericton, NB.

Reports D. simplex infestations in Nova Scotia in 1978.

128. Packard, A.S. 1890. **Insects injurious to forest and shade trees.** USDA, 5th Rep. U.S. Entomol. Comm., 957 pp. (pp. 722, 903).

Reports D. simplex from conifers in Canada.

129. Petty, J. 1967. **Annual district report Grande Prairie - Slave Lake district, 1966.** pp. 73-82 In District Reports of the Forest Insect and Disease Survey Alberta - Northwest Territories - Yukon region, 1966. Can. Dept. For. Rural Dev., For. Res. Lab., Info. Rep. A-X-6, Calgary, AB (p. 78).

Reports moderate infestations of D. simplex in a small tamarack stand 45 miles northwest of Slave Lake, NWT.

130. Prebble, M.L. 1933. **The larval development of three bark beetles.** Can. Ent. 65:145-150.

Average development time of eggs; first, second, third, fourth larval instars; and pupae in New Brunswick field populations was 11, 5, 6, 6, 10, and 7 days, respectively. Mean head capsule widths of successive larval instars were 0.41, 0.56, 0.76, and 0.99 mm, respectively.

131. Prentice, R.M. and V. Hildahl. 1959. **Provinces of Manitoba and Saskatchewan forest insect survey.** pp. 68-78 In Annual report of the Forest Insect and Disease Survey, 1958. Can. Dept. Agric., For. Biol. Div., Ottawa, ON (pp. 65-66).

Reports many localized D. simplex infestations in northwest Saskatchewan and in the Whiteshell forest reserve, Manitoba from 1956-58. There was 10% mortality in a plot of 50 tamarack at Buffalo Narrows, Saskatchewan.

132. Provancher, L.A. 1878. **Additions et corrections a la faune Colèopterologiqué de la province de Québec, part 2.** C. Darveau, Quebec, 18 pp.

A description of D. simplex adults is provided. This constitutes the first record of the species from Quebec.

133. Raske, A.G., J.D. Rowe and H.O. Schooley. 1978. **Preliminary report on an outbreak of the eastern larch beetle in Newfoundland.** File Rep.: study 1-2. Can. For. Serv., Nfld. For. Res. Cent., St. John's, NF, 22 pp. (unpublished).

Gives a summary of D. simplex life history and suggests spruce budworm defoliation of tamarack as a predisposing agent for D. simplex outbreaks in Newfoundland. During a survey of beetle-killed tamarack in 1978 along the Trans Canada Highway and some major secondary roads, 3400 dead trees were counted. Average DBH of killed trees was 20 cm (range 8-48 cm). The foliage of about 50% of infested trees turned yellow prematurely; the foliage of the other trees remained green, dried and fell prematurely.

134. Rose, A.H. and O.H. Lindquist. 1980. **Insects of eastern larch, cedar and juniper.** Can. For. Serv., Great Lakes For. Res. Cent., For. Tech. Rep. 28, Sault Ste. Marie, ON, 99 pp. (pp. 59-60).

Provides a brief review of D. simplex life history based on information from other publications.

135. Rush, P.A., T.A. Laurent, L.C. Yarger and R.K. Lawrence. 1977. **Forest insect and disease conditions in Alaska, 1976.** USDA, For. Serv., Alaska Region, Juneau, AK, 12 pp. (p. 2).

Reports D. simplex infested tamarack scattered over 142 000 ha (no change from previous year) southwest of Fairbanks.

136. _____. 1978. In **Forest insect and disease conditions in the United States 1976.** (H.D. Brown and P.W. Orr, comp.) USDA, For. Serv., Report, Washington, DC, 40 pp.

The area of scattered larch mortality remained at approximately 350,000 acres in Alaska in 1976, with increased activity in the northeastern portion of the infestation. Nearly 50% of the larch in this area has been killed.

137. Sajan, R.J. 1981. **Results of forest insect and disease surveys in the eastern region of Ontario, 1980.** Can. For. Serv., Great Lakes For. Res. Cent., Sault Ste. Marie, ON (p. 12).

Reports high D. simplex populations in tamarack in South Gower Township, Brockville district, Ontario.

138. Schofer, G.A. and G.N. Lanier. 1970. **A sexual character in pupae of Dendroctonus (Coleoptera: Scolytidae).** Can. Ent. 102:1487-1488.

A lobe protruding from between the eighth and ninth sternites of pupae was used to identify females. Males lacked this lobe in four Dendroctonus species including D. simplex.

139. Schooley, H.O. and K.E. Pardy. 1981. **Insect pests of larch in Newfoundland.** Can. For. Serv., Nfld. For. Res. Cent., Info. Rep. N-X-193, St. John's, NF, 23 pp. (pp. 6-7).

Gives general life history of D. simplex condensed from previous publications.

140. Schwarz, E.A. 1888a. **Coleopterological notes.** Proc. Ent. Soc. Washington 1:174-177.

D. simplex was collected from tamarack near Grand Lodge, MI in 1881-82 and at Marquette, MI in 1888. Drought was implicated as a stressing agent.

141. _____ 1888b. (no title). Insect Life 1:162.

Reports D. simplex attacking tamarack (probably in Michigan).

142. Silver, G.T. and D.A. Ross. 1961. **Province of British Columbia Forest Insect Survey.** pp. 93-105 In Annual report of the Forest Insect and Disease Survey, 1960. Can. Dept. For., Ottawa, ON (p. 98).

D. simplex infested flood-damaged tamarack south of Fort Nelson. This constitutes the first record of D. simplex from British Columbia.

143. _____ 1963. **Province of British Columbia Forest Insect Survey.** pp. 107-118 In Annual report of the Forest Insect and Disease Survey, 1962. Can. Dept. For., Ottawa, ON (p. 117).

Reports a D. simplex infestation in tamarack near Chetwynd, BC and in the Yukon.

144. Simpson, L.J. 1929. **The biology of Canadian bark beetles: the seasonal history of Dendroctonus simplex LeC.** Can. Ent. 61:274-279.

From 1925-28, D. simplex produced 1-3 broods per year in caged tamarack bolts. Most broods overwintered as young adults, however, the third brood of 1927 overwintered as larvae but died in the spring before reaching maturity.

145. Singh, P., B.H. Moody and L.J. Clarke. 1982. **Newfoundland region.** pp. 11-15 In Annual report of the Forest Insect and Disease Survey, 1979. Can. For. Serv., Ottawa, ON (p. 13).

Reports a severe infestation of tamarack by D. simplex along the Trans Canada Highway in central and western Newfoundland.

146. Sippell, W.L., J.E. MacDonald and A.H. Rose. 1961. **Province of Ontario Forest Insect Survey.** pp. 45-63 In Annual report of the Forest Insect and Disease Survey, 1960. Can. Dept. For., Ottawa, ON (p. 61).

Reports D. simplex infestations in tamarack and European larch at three locations in the Lake Erie forest district, Ontario.

147. _____ 1962. **Province of Ontario Forest Insect Survey.** pp. 55-72 In Annual report of the Forest Insect and Disease Survey, 1961. Can. Dept. For., Ottawa, ON (pp. 58, 69).

Reports D. simplex infestations in tamarack at numerous locations in four forest districts in Ontario.

148. _____ 1963. **Ontario forest insect conditions.** pp. 52-65 In Annual report of the Forest Insect and Disease Survey, 1962. Can. Dept. For., Ottawa, ON (p. 55).

Reports severe D. simplex infestations in tamarack in parts of Cochrane and Swastika forest districts, Ontario.

149. Sterner, T.E. and A.G. Davidson (compilers). 1981. **Forest insect and disease conditions in Canada, 1980.** Can. For. Serv., Forest Insect and Disease Survey, Ottawa, ON, 43 pp. (p. 8).

Summarizes D. simplex damage in Canada in 1980 (condensed from regional reports).

150. _____ 1982. **Forest insect and disease conditions in Canada, 1981.** Can. For. Serv., Forest Insect and Disease Survey, Ottawa, ON, 46 pp. (p. 11).

Summarizes D. simplex damage in Canada in 1981 (condensed from regional reports).

151. _____ 1983. **Forest insect and disease conditions in Canada, 1982.** Can. For. Serv., Forest Insect and Disease Survey, Ottawa, ON, 58 pp. (p. 14).

Summarizes D. simplex damage in Canada in 1982 (condensed from regional reports).

152. Susut, J.P. 1967. **Annual district report Peace River district, 1966.** pp. 83-91 In Annual district reports of the Forest Insect and Disease Survey or the Alberta - Northwest Territories - Yukon region, 1966. Can. Dept. For. Rural Dev., For. Res. Lab., Info. Rep. A-X-6, Calgary, AB (p. 87).

Reports a D. simplex infestation in the Meander River area, Yukon Territory.

153. Susut, J.P. 1969. **Annual district report Yukon Territory, 1968.** pp. 79-86 In Annual district reports of the Forest Insect and Disease Survey Alberta - Northwest Territories - Yukon region, 1968. Can. Dept. Fish. For., For. Res. Lab., Info. Rep. A-X-22, Calgary, AB (p. 83).

Reports low D. simplex populations in tamarack at Frances Lake, Yukon Territory.

154. Swaine, J.M. 1911. **Some insects of the larch.** Ann. Rep. Ent. Soc. Ontario 41:81-88.

In 1910, D. simplex was observed attacking cut logs and stumps of tamarack near Ste. Anne's, Quebec. Larvae were present by July 10. By August some brood had matured and a second brood had been started by emerged adults in nearby logs. From one to four eggs were laid in each egg pocket along the sides of galleries and galleries contained turning niches. Sometimes two females used the same entrance hole but constructed different galleries. Eggs and larvae of the second brood occurred as late as 26 August and reached maturity in the laboratory in early October.

155. _____ 1913. **Notes on some forest insects of 1912.** Ann. Rep., Ent. Soc. Ontario 43:87-91.

D. simplex is reported from many locations (not listed) in Canada but the primary cause of tamarack mortality in these areas is uncertain.

156. _____ 1918. **Canadian bark beetles, part 1. Descriptions of new species.** Can. Dept. Agric., Ent. Branch, Bull. no. 14, 143 pp. (pp. 12, 14, 19-20, 62-63).

A description and the distribution of D. simplex is provided along with some observations on egg galleries similar to those of Swaine (1911). Oviposition behaviour is described. Before oviposition a female cuts an egg pocket into the side of the gallery at the distal end, backs down the gallery to a turning niche where she turns around, returns to the distal end of the gallery and, oviposits in the egg pocket. Following oviposition she reverses directions again in a turning niche and returns to elongating the egg gallery.

157. Teillon, H.B., B.S. Burns and R.S. Kelley. 1981. **Forest insect and disease conditions in Vermont, calender year 1981.** Dept. For. Pks. Rec., Montpelier, VT (pp. 2-4).

D. simplex was associated with reputed tamarack decline and mortality over 8363 acres in 1981, especially in northern Vermont.

158. Teillon, H.B., B.S. Burns and R.S. Kelley. 1982. **Forest insect and disease conditions in Vermont, calender year 1982.** Dept. For. Pks. Rec., Montpelier, VT (p. 27).

D. simplex was associated with reputed tamarack decline and mortality over 9000 acres, mostly in northern Vermont. In some areas tamarack mortality was near 100%.

159. _____ 1983. **Forest insect and disease conditions in Vermont, calender year 1983.** Dept. For. Pks. Rec., Montpelier, VT (p. 24).

D. simplex continued to be associated with tamarack decline in Vermont which decreased to 5000 acres in 1983 in Vermont.

160. _____ 1986. **Forest insect and disease conditions in Vermont, calender year 1986.** Dept. For. Pks. Rec., Montpelier, VT 40 pp. (p. 25).

D. simplex was associated with 43 ha of tamarack decline, mainly in northeastern Vermont.

161. Teillon, H.B., R.S. Kelley and E.E. Keenan. 1979. **Forest insect and disease conditions in Vermont, calender year 1979.** Dept. For. Pks. Rec., Montpelier, VT (p. 9).

D. simplex was associated with 4000 acres of larch decline in Bennington and Rutland counties in Vermont. A change in the water table was thought to have stressed the tamarack.

162. Teillon, H.B., R.S. Kelley and B.D. Schultz. 1980. **Forest insect and disease conditions in Vermont, calender year 1980.** Dept. For. Pks. Rec., Montpelier, VT (p. 13).

D. simplex and larch casebearer were associated with tamarack decline on 7080 acres in four counties in Vermont.

163. Thomas, J.B. 1957. **The use of larval anatomy in the study of bark beetles (Coleoptera: Scolytidae).** Can. Ent. 89, suppl. 5, 45 pp. (pp. 20, 37, 43).

Describes external morphology of D. simplex larvae and compares diagnostic characteristics to three other Dendroctonus species and to other scolytid genera.

164. _____ 1965. **The immature stages of Scolytidae: the genus Dendroctonus Erichson.** Can. Ent. 97:374-400.

Describes and illustrates D. simplex larvae and pupae and provides a key to larvae and pupae of Dendroctonus.

165. _____ 1967. **A comparative study of gastric caecae in adult and larval stages of bark beetles (Coleoptera: Scolytidae).** Proc. Ent. Soc. Ontario 97:71-90 (p. 75).

D. simplex larvae have an average of 60 caecae (range 50-75) in each of two bands on either side of the midgut. Adults have 70-105 caecae distributed around the circumferance of the midgut.

166. Thomson, M.J. 1964. **Status of insects in the Fort Frances district.** pp. G36-42 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1963. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. G38).

Reports a severe D. simplex infestation in tamarack in Dobie Township, Ontario. Larch sawfly defoliation and drought are implicated as stressing agents.

167. Trieselmann, R.A. 1963. **Status of insects in the Gogama district.** pp. D41-55 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1962. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. D51).

Reports high D. simplex populations in Muskego Township, Ontario.

168. Trinnell, J.R. 1962. **Status of insects in the Gogama district.** pp. 266-283 In Annual district reports of the Forest Insect and Disease Survey Ontario, 1961. Can. Dept. Agric., For. Biol. Div., Sault Ste. Marie, ON (p. 278).

D. simplex was collected from one tamarack in Muskego Township, Ontario.

169. Tripp, H.A. and R.A. Blauel. 1969. **Alberta - Northwest Territories - Yukon region.** pp. 98-110 In Annual report of the Forest Insect and Disease Survey, 1968. Can. For. Serv., Ottawa, ON (p. 104).

Reports D. simplex infestations in central Alberta and near Frances Lake, Yukon.

170. Tripp, H.A. and J.K. Robins. 1968a. **Annual report of the Forest Insect and Disease Survey Alberta - Northwest Territories - Yukon region, 1967.** Can. Dept. For., For. Res. Lab., Info. Rep. A-X-15, Calgary, AB (pp. 23).

Reports low D. simplex populations in Chisholm Tower and Dixonville areas of the Peace River district of Alberta.

171. _____ 1968b. **Alberta - Northwest Territories - Yukon region.** pp. 97-107 In Annual report of the Forest Insect and Disease Survey, 1967. Can. Dept. For. Rural. Dev., Ottawa, ON (p. 101).

Reports small D. simplex infestations at several locations in central Alberta.

172. Tripp, H.A., J.K. Robins and R.A. Blauel. 1970. **Alberta - Northwest Territories - Yukon region.** pp. 84-96 In Annual report Forest Insect and Disease Survey, 1969. Can. For. Serv., Ottawa, ON (p. 89).

Reports light damage of tamarack caused by D. simplex in Alberta and up to 10% mortality in some stands in the Northwest Territories.

173. United States Department of Agriculture. 1907. **Yearbook of the U.S. Department of Agriculture, 1906.** Washington, DC, 720 pp. (p. 515).

Reports D. simplex in tamarack in the upper peninsula of Michigan.

174. _____ 1979a. **Forest insect and disease conditions in Alaska, 1977.** USDA, For. Serv., Alaska Region, Ser. R10-31, Juneau, AK, 11 pp. (p. 3).

The D. simplex outbreak increased to cover 215 000 ha in 1977 and spread northeastward into the Tanana River valley near Fairbanks, Alaska.

175. _____ 1979b. **Forest insect and disease conditions in Alaska in 1978.** USDA, For. Serv., Alaska Region, Rep. 62, Juneau, AK, 35 pp. (pp. 7-8).

The D. simplex outbreak decreased 15-fold from the previous year in 1978 and covered only 14 000 ha in 1978. The infestation continued to spread northeastward along the Kantishna and Tanana River drainages in Alaska.

176. _____ 1980. **Forest insect and disease conditions in Alaska in 1979.** USDA, For. Serv., Alaska Region, Rep. 115, Juneau, AK, 17 pp. (pp. 6-7).

D. simplex infestations continued to decrease in Alaska and covered 6500 ha in 1979, mostly along the banks of the Tanana and Teklanika Rivers, southeast of Fairbanks and also near Anvik, along the Yukon River.

177. _____ 1981. **Forest insect and disease conditions in Alaska in 1980.** USDA, For. Serv., Alaska Region, Rep. 146, Juneau, AK, 17 pp. (pp. 5-6).

D. simplex infestations increased slightly in Alaska to 8000 ha in 1980, mostly along Susulatna River, northwest of Medfra and along the Yukon River west of Galena.

178. _____ 1983. **Forest insect and disease conditions in Alaska, 1981-82.** USDA, For. Serv., Alaska Region, Rep. 173, Juneau, AK, 24 pp. (p. 16).

Areas of D. simplex infestations in Alaska decreased to only 3 ha from 1981-82.

179. United States Department of Agriculture. 1984. **Forest insect and disease conditions in Alaska in 1983.** USDA, For. Serv., Alaska Region, Rep. R-10, Juneau, AK, 25 pp. (pp. 6-7).

D. simplex infestations covered 45 ha in Alaska in 1983.

180. Viereck, H.L. 1925. **New genera and species of Ichneumonidae in the Canadian National Collection.** Can. Ent. 57:71-78.

Comphorius (=Cosmophorinus) dendroctoni Viereck (Braconidae) was recorded as a parasitoid of D. simplex in New Brunswick.

181. Weber, H.G. 1942. **Division of Forestry.** pp. 64-97 In Statistical report for Biennium ending June 30, 1942. Minnesota Dept. Conserv. (p. 79).

Reports a serious D. simplex outbreak in the Pine Island State Forest of Minnesota. Other infestations were reported near Grand Rapids, Lake Minnetonka and Cambridge.

182. Weir, H.J. and W.D. Biggs. 1974. **Forest insect and disease conditions in the southwest survey region, 1973.** Can. For. Serv., Great Lakes For. Res. Cent., Info. Rep. O-X-194, Sault Ste. Marie, ON, 26 pp. (p. 11).

Reports D. simplex infestation in Galway Township, Lindsay district of Ontario.

183. Weir, H.J., M.J. Thomson, D.C. Constable and C.G. Jones. (compilers). 1985. **A review of important forest insect and disease problems in the Cochrane district of Ontario, 1950-80.** Can. For. Serv., Great Lakes For. Res. Cent., Misc. Rep. no. 28, Sault Ste. Marie, ON, 110 pp. (pp. 83-85).

In 1961, high population levels of D. simplex occurred in Ontario in tamarack stands with a history of larch sawfly infestations. In Glackmeyer Township tamarack mortality reached 71%. In 1962, high population levels occurred in six townships. Beetles attacked from 10% to 80% of tamarack in stands in Adair and Calder townships, respectively. Populations declined to low levels in 1963.

184. _____ 1986. **A review of important forest insect and disease problems in the Kirkland Lake district of Ontario, 1950-80.** Can. For. Cent., Great Lakes For. Res. Cent., Misc. Rep. no. 34, Sault Ste. Marie, ON, 133 pp. (pp. 54-55).

D. simplex populations killed tamarack in Ontario in the district from 1961-63.

185. Werner, R.A. 1986. **The eastern larch beetle in Alaska.** USDA, For. Serv., Pacific Northw. Res. Stn., Res. Pap. PNW-357, Portland, OR, 13 pp.

Contains descriptions of the life history, egg galleries, oviposition, development, and mortality of D. simplex in Alaska. The species has a 1-year life cycle. Beetles attacked trees of all size classes, but the larger trees were more frequently attacked. Repeated defoliation by Zeiraphera sp. (Tortricidae) was a major predisposing agent for the D. simplex outbreak in Alaska.

186. Werner, R.A., M.M. Furniss, L.C. Yarger and T. Ward. 1981. **Effects on eastern larch beetle of its natural attractant and synthetic pheromones in Alaska.** USDA, For. Serv., Pacific Northw. For. Range Exp. Stn., Res. Note PNW-371, Portland, OR, 7 pp.

Traps baited with seudenol and α-pinene caught 87% more beetles than tamarack logs baited with females. D. simplex was not attracted to frontalin and was inhibited by addition of 3-methyl-2-cyclohexen-1-one (MCH).

187. Westcott, C. 1970. **The gardener's bugbook.** Doubleday and Co., Inc., Garden City, NY, 625 pp. (p. 100).

D. simplex is reported as a pest of larches. Egg galleries are described as long, longitudinal and winding.

188. Wilson, L.F. 1977. **A guide to insect injury of conifers in the Lake States.** USDA, For. Serv., Agric. handbook no. 501, Washington, DC, 218 pp. (p. 71).

Identifies damage by D. simplex and contains photos of infested trees and galleries.

189. Wood, S.L. 1963. **A revision of the bark beetle genus Dendroctonus Erichson (Coleoptera: Scolytidae).** Great Basin Natur. 23:1-117 (pp. 103-06).

Contains description of adults, distribution map, summary of biology condensed from publications and a key to species of the genus.

190. _____ 1982. **The bark and ambrosia beetles of North and Central America (Coleoptera: Scolytidae), a taxonomic monograph.** Great Basin Naturalist Memoirs 6. Brigham Young University, Provo, UT, 1359 pp. (pp. 197-199).

Contains description of adults, distribution maps, summary of biology summarized from publications and a key to all species of the genus.

191. Woodring, J.P. and J.C. Moser. 1970. **Six new species of anoetid mites associated with North American Scolytidae.** Can. Ent. 102:1237-1257.

Anoetus varia Woodring and Moser (Anoetidae) was phoretic on D. simplex from Grande Prairie, Alberta.

192. Yarger, L.C., E.H. Holsten and T.A. Laurent. 1978. In **Forest insect and disese conditions in the United States 1977.** (P.W. Orr and H.D. Brown, comp.) USDA, For. Serv., Report, Washington, DC, 88 pp. (p. 73).

The eastern larch beetle infestation in Alaska increased to 532,000 acres from 350,000 acres in 1976. The infestation occurs along several rivers southwest of Fairbanks.

AUTHOR INDEX

AUTHOR	REFERENCE NUMBER(S)
Anderson, R.F.	1
Applejohn, M.J.	2, 73
Ashworth, A.C.	3
Averil, R.D.	66
Baker, B.H.	4, 5, 6, 7
Baker, W.L.	8
Banfield, E.C.	29, 30, 31, 32
Baranyay, J.A.	9
Barker, R.B.	122
Barr, B.A.	10
Benoit, P.	11, 12, 13, 82, 83
Bentz, B.J.	14, 15
Bergdahl, D.R.	16, 17
Biggs, W.D.	181
Blackman, M.W.	18
Blais, R.	11
Blauel, R.A.	169, 172
Bonneau, G.	12, 13, 82, 83
Bright, D.E.	19, 20
Brown, A.W.A.	21
Brown, C.E.	22, 23
Browne, F.G.	24
Burke, H.E.	41
Burks, B.D.	80
Burns, B.S.	157, 158, 159, 160
Bushing, R.W.	25
Caltrell, R.M.	26, 27
Carew, G.C.	29, 30, 31, 32, 33, 34, 35, 35, 36, 37
Carolin, V.M.	55
Chamberlin, W.J.	28, 41
Clarke, L.J.	29, 30, 31, 32, 33, 34, 35, 36, 37, 124, 145
Cockerell, T.D.A.	47
Constable, D.C.	183, 184
Craighead, F.C.	38
Davidson, A.G.	149, 150, 151
Dearborn, R.G.	39
Dietz, W.G.	40
Doane, R.W.	41
Dodge, H.R.	42
Drouin, J.A.	43
Duncan, B.	44
Emond, F.J.	45
Eglitis, A.	64
Eidmann, H.	46
Fall, H.C.	47
Felt, E.P.	48, 49
Foster, H.R.	50, 51, 52, 53
Furniss, M.M.	4, 54, 186
Furniss, R.L.	55
Gautreau, E.J.	56
Grisdale, D.G.	57, 58
Gross, H.L.	73
Halik, S.S.	17
Harrington, W.H.	59, 60
Hennon, P.E.	65
Herrick, G.W.	61
Hewitt, C.G.	62
Hildahl, V.	131
Hofaker, T.H.	63, 101, 102
Holsten, E.H.	64, 65, 66, 191
Hopkins, A.D.	67, 68, 69, 70, 71
Hopkins, M.C.	22
Hostetler, B.B.	4, 5, 6, 72
Howse, G.M.	73
Hurd, P.D.	80
Jackson, G.G.	74
Jansons, V.	75, 76
Jones, C.G.	183, 184
Keenan, E.E.	161
Kelley, R.S.	157, 158, 159, 160 161, 162
Kondo, E.S.	77 78, 79
Krombien, K.V.	80, 125
Kusch, D.S.	81
Lachance, D.	82, 83
Laflamme, G.	12, 13, 82, 83
Langor, D.W.	84, 85, 86, 87, 88 89, 90, 91
Lanier, G.N.	92, 93, 138
Laurent, T.A.	5, 6, 7, 64, 66, 72, 135, 136, 192
Lawrence, R.K.	135, 136
Layton, C.R.	94, 95, 96, 97

AUTHOR	REFERENCE NUMBER(S)
LeConte, J.L.	98, 99
Lindquist, O.H.	134
Livesey, F.	100
Loomis, R.C.	63, 101, 102
MacDonald, J.E.	146, 147, 148
MacLeod, L.S.	58
Magasi, L.P.	103, 104, 105, 106 107, 108, 109, 110 111, 112, 113, 114 115, 116, 117, 118
Maine Dept. Conserv...	119, 120
Martineau, R.	121
Mason, W.R.M.	122
McGuffin, W.C.	123
Moody, B.H.	124, 145
Moser, J.C.	191
Muesebesk, C.F.W.	125
Myron, D.T.	73
Newell, R.	126, 127
O'Brien, D.S.	29, 30, 31, 32
Packard, A.S.	128
Pardy, K.E.	29, 30, 31, 32, 139
Petty, J.	129
Picher, R.	12, 13, 83
Prebble, M.L.	130
Prentice, R.M.	131
Provancher, L.A.	132
Rankin, W.H.	49
Raske, A.G.	87, 88, 89, 90 91, 133
Robins, J.K.	22, 170, 171, 172
Rose, A.H.	134, 146, 147, 148
Ross, D.A.	142, 143
Rowe, J.D.	133
Rush, P.A.	72, 135, 136
Sajan, R.J.	137
Schofer, G.A.	138
Schooley, H.O.	133, 139
Schwarz, E.A.	140, 141
Schwert, D.P.	3
Schultz, B.D.	162
Silver, G.T.	142, 143
Simpson, L.J.	144
Singh, P.	124, 145
Sippell, W.L.	146, 147, 148
Smeltzer, D.L.K.	17
Smith, D.R.	80
Stage, H.H.	18
Stark, D.A.	39
Sterner, T.E.	149, 150, 151
Stevenson, R.E.	9, 23
Stock, M.W.	15
Stone, D.M.	29, 30, 31, 32
Susut, J.P.	152, 153
Sutton, W.J.	29, 30, 31, 32
Swaine, J.M.	154, 155, 156
Syme, P.D.	73
Taylor, R.G.	77, 78, 79
Teillon, H.B.	157, 158, 159, 160 161, 162
Thomas, J.B.	163, 164, 165
Thomson, M.J.	166, 183, 184
Townes, H.K.	125
Trieselmann, R.A...	167
Trinnell, J.R.	168
Tripp, H.A.	169, 170, 171, 172
Tucker, S.M.	63, 102
Turnock, W.J.	43
U.S. Dept. Agric...	173, 174, 175, 176, 177, 178, 179
van Dyke, E.C.	41
Viereck, H.L.	180
Watts, W.A.	3
Ward, T.	186
Weber, H.G.	181
Weir, H.J.	182, 183, 184
Werner, R.A.	65, 185, 186
Westcott, C.	187
Wilson, L.F.	188
Wood, S.L.	189, 190
Woodring, J.P.	191
Wright, H.E., Jr...	3
Yarger, L.C.	135, 136, 186, 192

SUBJECT INDEX

SUBJECT	REFERENCE NUMBER(S)
Associated organisms	
fungi	16
insects	18, 54, 85
mites	85, 191
nematodes	16, 17, 85
spiders	85
Chromosomes	92
Cold tolerance	85, 88
Control	1, 48, 61, 71, 114, 185
Cross-breeding studies	54
Damage estimates	
New Brunswick	87, 91, 105, 109, 110, 116
Newfoundland	32, 91, 133
Nova Scotia	87, 91, 104, 105, 109, 110, 116
Prince Edward Island	87, 91, 104, 105, 109, 110, 116
Quebec	71, 82, 83, 91
Development	1, 85, 89, 130, 144, 154
Distribution	19, 20, 24, 28, 38, 40, 41, 42, 43, 44, 54, 55, 70, 71, 81, 85, 91, 156, 185
Egg galleries	1, 70, 71, 85, 89, 154, 156, 187, 189, 190
Emergence	84, 85, 86, 88, 154, 185, 189, 190
Enzyme variability	14, 15
Flight muscles	84, 85, 86, 185
Fossils	3
Genitalia	54
Host attack	43, 84, 85, 86, 88, 154, 185, 189, 190
Host species	20, 24, 28, 49, 50, 67, 85, 91, 123, 146, 189, 190
Larval instars	46, 85, 89, 130, 185

SUBJECT	REFERENCE NUMBER(S)
Life history	1, 8, 18, 20, 24, 28, 38, 42, 48, 54, 55, 84, 85, 86, 87, 88, 89, 112, 133, 134, 139, 144, 185, 189, 190
Mating	84, 85, 86, 89
Morphology	
adult external	10, 20, 28, 38, 40, 44, 54, 61, 69, 70, 98, 99, 132, 156, 189, 190
adult internal	55, 84, 86, 87
eggs	86, 89
larvae	70, 163, 164, 165
pupae	70, 138, 164
Mortality	18, 86, 90, 185
Overwintering	71, 85, 88, 144, 185
Oviposition	85, 89, 156, 185
Parasitoids	18, 25, 28, 54, 80, 85, 90, 122, 125, 180
Pheromones and attractants	4, 186
Pinewood nematode	16, 17
Predators	18, 42, 85, 90
Predisposing factors	9, 16, 17, 29, 36, 43, 52, 57, 58, 85, 87, 91, 100, 133, 140, 166, 183, 185
Re-emergence	84, 85, 86, 88, 185
Sex ratio	85, 88, 185
Stridulation	10, 54, 85, 89
Surveys	5, 6, 7, 11, 32, 63, 64, 65, 66, 72, 82, 83, 91, 101, 102, 104, 105, 109, 110, 116, 133, 136, 157, 158, 159, 160, 161, 162, 174, 175, 176, 177, 178, 179, 192
Taxonomy	14, 15, 20, 44, 98, 99, 163, 164, 189, 190

GEOGRAPHIC INDEX

PUBLICATIONS CONTAINING SURVEY INFORMATION

AREA	REFERENCE NUMBER(S)
Alaska	5, 6, 7, 55, 63, 64, 65, 66, 72, 91, 101, 135, 136, 174, 175, 176, 177, 178, 179, 192
Alberta	9, 22, 23, 26, 27, 45, 62, 81, 91, 94, 95, 96, 97, 123, 152, 169, 170, 171, 172
British Columbia	44, 91, 142, 143
Labrador	35, 36, 91
Maine	39, 91, 102, 119, 120
Manitoba	43, 91, 131
Michigan	40, 41, 91, 140, 173
Minnesota	42, 91, 181
Newfoundland	19, 29, 30, 31, 32, 33, 34, 35, 36, 37, 91, 124, 133, 145
New Brunswick	91, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118
New Hampshire	91, 102
New York	18, 91, 93, 102
Northwest Territories	9, 56, 91, 129, 172
Nova Scotia	21, 91, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 126, 127
Ontario	2, 50, 51, 52, 53, 57, 58, 59, 60, 73, 74, 75, 76, 91, 100, 137, 146, 147, 148, 166, 167, 168, 182, 183, 184
Prince Edward Island	91, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 126

AREA	REFERENCE NUMBER(S)
Quebec	11, 12, 13, 82, 83, 91, 132
Saskatchewan	43, 91, 131
Vermont	16, 17, 91, 102, 157, 158, 159, 160, 161, 162
West Virginia	68, 69, 91
Yukon	91, 143, 152, 153, 169